SecureDapp

DApp Developers and Smart Contract Auditors

SMART CONTRACT SECURITY AUDIT

of

TENEX CONTRACTS

Smart Contract Audit of Tenex

Aug 5th, 2024 | v. 1.0

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AUDIT INTRODUCTION

Auditing Firm	SecureDApp Auditors
Audit Architecture	SecureDApp Auditing Standard
Language	Solidity
Client Firm	Tenex
Website	Tenex
Twitter	https://x.com/TenEx_Official
Discord	https://discord.com/invite/VcrzxkYV6y
Report Date	Aug 5th, 2024

About Tenex

TenEx is a Next-gen DEX which aims to revolutionize liquidity provision and user trading Exp with autonomous liquidity and NFT-Lock positions.

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AUDIT DOCUMENT

Name	Smart Contract Code Review and Security Analysis Report for Tenex
Approved By	Himanshu Gautam| CTO at SecureDApp
Type	DEX
Platform	EVM
Language	Solidity
Changelog	05.08.2024 – Final Review

AUDIT SCOPE

The scope of this report is to audit the smart contract source code of Tenex contracts.
Our client provided us with one smart contract.

- Tenex.sol

The contract is written in Solidity and based on the Openzepplin Standard.
After initial research, we agreed to perform the following tests and analyses as part of our well-rounded audit:

- Smart contract behavioral consistency analysis
- Test coverage analysis
- Penetration testing: checking against our database of vulnerabilities and simulating manual attacks against the contracts
- Static analysis
- Manual code review and evaluation of code quality
- Analysis of GAS usage
- Contract analysis with regards to the host network

Initial Review Scope

Repository	https://github.com/Tenex-Finance/smart-contracts/blob/main/contracts/Tenex.sol
Commit Hash	74c6f19542f7feb87acd1fd934fb74c80e0eaed3
Functional Requirements	Partial documentation provided. README.md
Technical Requirements	Partial documentation provided. README.md
Contracts Addresses	-
Contracts	Tenex.sol

Severity Definitions

Risk Level	Description
Critical	Critical vulnerabilities are usually straightforward to exploit and can lead to asset loss or data manipulations.
High	High-level vulnerabilities are difficult to exploit; however, they also have a significant impact on smart contract execution, e.g., public access to crucial functions.
Medium	Medium-level vulnerabilities are important to fix; however, they cannot lead to asset loss or data manipulations.
Low	Low-level vulnerabilities are mostly related to outdated, unused, etc. code snippets that cannot have a significant impact on execution.
Informational	Issue listed to improve understanding, readability and quality of code

All statuses which are identified in the audit report are categorized here for the reader to review:

Status Type	Definition
Open	Risks are open.
Acknowledged	Risks are acknowledged, but not fixed.
Resolved	Risks are acknowledged and fixed.

AUDIT SUMMARY

The SecureDApp team has performed a line-by-line manual analysis and automated review of smart contracts. Smart contracts were analyzed mainly for common contract vulnerabilities, exploits, and manipulation hacks. According to the audit:

Status	Critical	High	Medium	Low	Informative
Open	0	0	2	1	2
Acknowledged	1	0	0	0	0
Resolved	0	0	2	1	2

AUDIT METHODOLOGY

SecureDApp scans contracts and reviews codes for common vulnerabilities, exploits, hacks and back- doors. Mentioned are the steps used by SecureDApp to audit smart contracts:

a. Smart contract source code reviewal:
    i. Review of the specifications, sources, and instructions provided to SecureDApp to make sure we understand the audit scope, intended business behavior, overall architecture, and project's goal.
    ii. Manual review of code, which is the process of reading source code line-by-line to identify potential vulnerabilities.
b. Test coverage analysis: (Unit testing)
    i. Test coverage analysis is the process of determining whether the test cases are covering the code and how much code is exercised when we run those test cases.
c. Static analysis:
    i. Run a suite of vulnerability detectors to find security concerns in smart contracts with different impact levels.
d. Symbolically executed tests: (SMTChecker testing) (Taint analysis)
    i. Symbolic execution is analyzing a program to determine what inputs cause each part of a program to execute.
    ii. Check for security vulnerabilities using static and dynamic analysis
e. Property based analysis (Fuzz tests)(Invariant testing)
    i. Run the execution flow multiple times by generating random sequences of calls to the contract.
    ii. Asserts that all the invariants hold true for all scenarios.
f. Best practices review, which is a review of the smart contracts to improve efficiency, effectiveness, clarify, maintainability, security, and control based on the established industry and academic practices, recommendations, and research.
g. Specific, itemized, actionable recommendations to help you take steps to secure your smart contracts.

Automated 5S frameworks used to assess the smart contract vulnerabilities

- Consensys Tools
- SWC Registry
- Solidity Coverage
- Open Zeppelin Code Analyzer
- Solidity Shield Scan

We have audited the smart contracts for commonly known and more specific vulnerabilities.
Below is the list of smart contract tests, vulnerabilities, exploits, and hacks:

ID	Description	Status
EEA 3.3	Oracle Manipulation	N/A
EEA 3.3	Bad Randomness - VRF	N/A
S60	Assembly Usage	Passed
S59	Dangerous usage of block.timestamp	Passed
EEA 3.7	Front-Running Attacks	N/A
EEA 3.7	Back-Running Attacks	N/A
EEA 3.7	Sandwich Attacks	N/A
DASP	Gas Griefing Attacks	Passed
DASP	Force Feeding	Passed
SCSVS V2	Access Control	Passed
DASP	Short Address Attack	Passed
DASP	Checks Effects Interactions	Passed
EEA 4.1	No Self-destruct	Passed
SCSVS V14	Decentralized Finance Checks	Passed

Slither Tests	Checks for ERC's conformance	Passed
Coverage	Unit tests with 100% coverage	-
Gas Reporter	Gas usage & limitations	Passed
Echidna Tests	Malicious input handling	Passed
SWC-101	Integer Overflow and Underflow	Passed
SWC-102	Outdated Compiler Version	Passed
SWC-103	Floating Pragma	Passed
SWC-104	Unchecked Call Return Value	Passed
SWC-105	Unprotected Ether Withdrawal	Passed
SWC-106	Unprotected SELF-DESTRUCT Instruction	Passed
SWC-107	Re-entrancy	Passed
SWC-108	State Variable Default Visibility	Passed
SWC-109	Uninitialized Storage Pointer	Passed
SWC-110	Assert Violation	Passed
SWC-111	Use of Deprecated Solidity Functions	Passed
SWC-112	Delegate Call to Untrusted Callee	Passed

SWC-113	DoS with Failed Call	Passed
SWC-114	Transaction Order Dependence	Passed
SWC-115	Authorization through tx.origin	Passed
SWC-116	Block values as a proxy for time	Passed
SWC-117	Signature Malleability	Passed
SWC-134	Message call with the hardcoded gas amount	Passed
SWC-135	Code With No Effects (Irrelevant/Dead Code)	Informational
SWC-136/SCSVS V3	Unencrypted Private Data On-Chain	Passed

SYSTEM OVERVIEW

Privileged roles

1. Contract Owner Role
    a. setMinter
    b. setMerkleClaim
2. Minter Role:
    a. Mint new tokens

Risks

1. The impact of the owner role being compromised would have a huge impact on the protocol.
2. Centralization risk is the most common cause of cryptography asset loss.
3. Compromising the Owner Role may lead to all user's asset loss.

FINDINGS

Centralization Risk

Centralization risk is the most common cause of dapp's hacks. When a smart contract has an active contract ownership, the risk related to centralization is elevated. There are some well-intended reasons to be an active contract owner, such as:

- Contract owners can be granted the power to pause() or lock() the contract in case of an external attack.
- Contract owners can use functions like, include(), and exclude() to add or remove wallets from fees, swap checks, and transaction limits. This is useful to run a presale, and to list on an exchange.

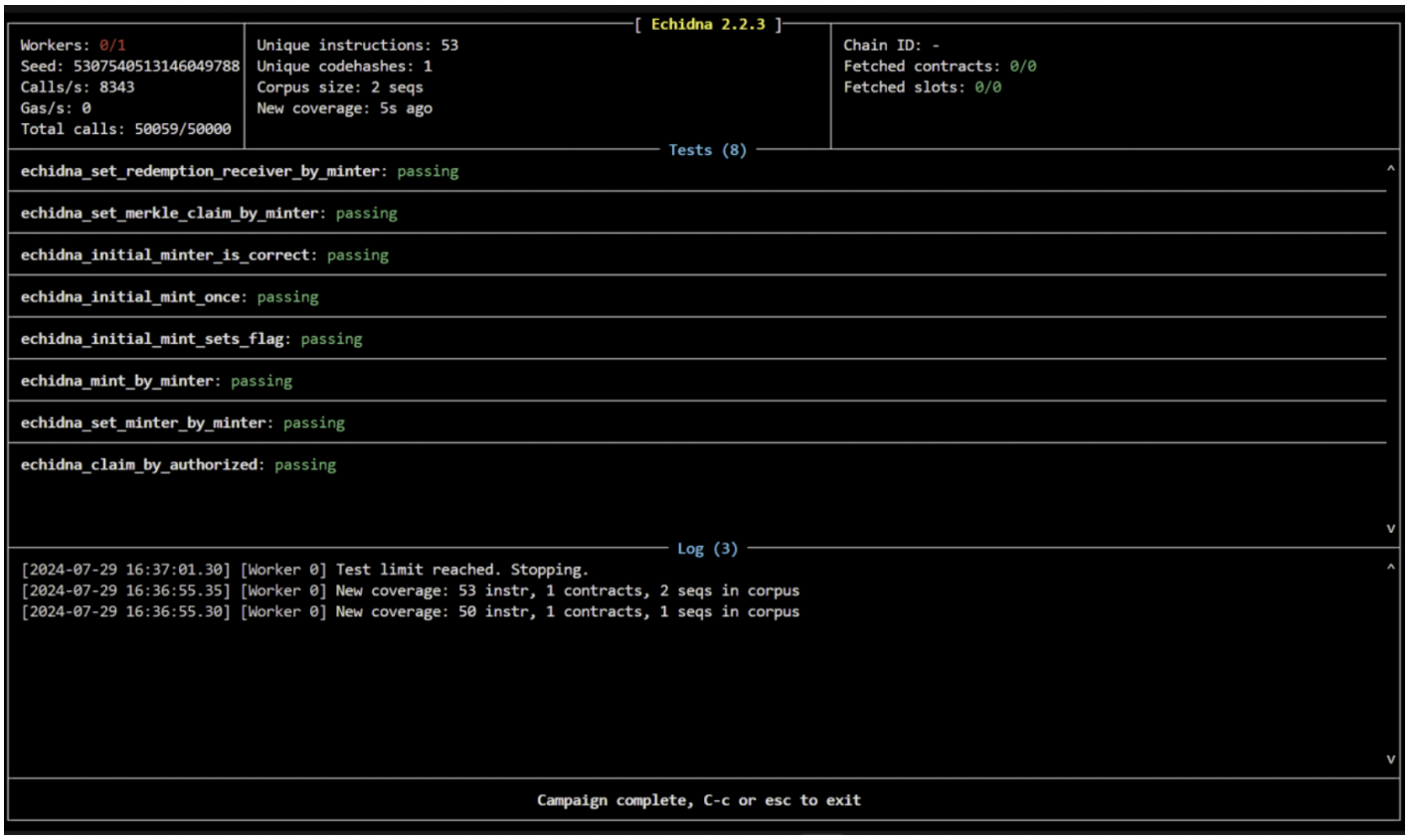
Authorizing a full centralized power to a single body can be dangerous. Unfortunately, centralization related risks are higher than common smart contract vulnerabilities. Centralization of ownership creates a risk of rug pull scams, where owners cash out tokens in such quantities that they become valueless. Most important question to ask here is, how to mitigate centralization risk? Here's SecureDApp's recommendation to lower the risks related to centralization hacks:

- Smart contract owner's private key must be carefully secured to avoid any potential hack.
- Smart contract ownership should be shared by multi-signature (multi-sig) wallets.
- Smart contract ownership can be locked in a contract, user voting, or community DAO can be introduced to unlock the ownership.

Tenex Centralization Status

- Tenex smart contract has Contract Ownership Role.

ECHIDNA REPORT



MANUAL REVIEW

Identifier	Definition	Severity
CEN-01	Centralization privileges of Tenex Contract Owner	Critical

Centralized privileges are listed below:

- Contract Owner Role :
  - setMinter
  - setMerkleClaim

RECOMMENDATION

Use Openzepplin Access Control framework instead or Ownable module to avoid single point of failure. Usage of Multi-Sig wallet for authorisation is recommended. Please refer to CENTRALIZED PRIVILEGES for a detailed understanding.

Status: ACKNOWLEDGED

Tenex team will be using multi-sig wallet to control ownership of contract and minter roles.

Identifier	Definition	Severity
MED-01	Missing Events for Important Configuration Changes	Medium

RECOMMENDATION

Implement events to log important configuration changes. Events provide a way to track and audit changes made to critical contract settings. For example, when changing important configuration parameters, emit an event to capture details about the change, including the old and new values and the address of the caller. This practice improves transparency and enables easier tracking of significant actions.

Status: Resolved

Tenex team has added events for important configuration changes

Identifier	Definition	Severity
MED-02	Missing Zero Address Checks	Medium

RECOMMENDATION

Incorporate checks to ensure that addresses are not zero before performing operations that involve those addresses. For instance, verify that an address is not zero when setting or using addresses in contract functions to prevent issues related to invalid or unintended address usage. Add require statements to enforce these checks, such as require(address != address(0), "Invalid address").

Status: Resolved

Tenex team has added zero address check modifiers.

Identifier	Definition	Severity
LOW-01	Use of Floating Pragma	Low

RECOMMENDATION:

Ensure that the Solidity compiler version is fixed and specified clearly in the pragma statement to avoid compatibility issues and potential vulnerabilities. Instead of using a floating pragma like pragma solidity ^0.8.0;, specify an exact version or a range of compatible versions, such as pragma solidity 0.8.18;. This practice helps maintain code stability and predictability.

Status: Resolved

Tenex team has set solidity version to 0.8.19

Identifier	Definition	Severity
INF-01	Use Modifiers for Access Control	Informative

RECOMMENDATION

Utilize modifiers for access control rather than inline conditionals. Define a modifier such as `onlyMinter` to check if `msg.sender` is authorized, and use it to manage access control within functions.

Status: Resolved

Tenex team has added modifiers for the minter role.

Identifier	Definition	Severity
INF-02	Unused Code	Informative

RECOMMENDATION

Remove Owner declaration as it is not used anywhere in code

Status: Resolved

DISCLAIMER

SecureDApp Auditors provides the easy-to-understand audit of solidity source codes (commonly known as smart contracts).

The smart contract for this particular audit was analyzed for common contract vulnerabilities, and centralization exploits. This audit report makes no statements or warranties on the security of the code. This audit report does not provide any warranty or guarantee regarding the absolute bug-free nature of the smart contract analyzed, nor do they provide any indication of the client's business, business model or legal compliance. This audit report does not extend to the compiler layer, any other areas beyond the programming language, or other programming aspects that could present security risks. Cryptographic tokens are emergent technologies, they carry high levels of technical risks and uncertainty. You agree that your access and/or use, including but not limited to any services, reports, and materials, will be at your sole risk on an as-is, where-is, and as-available basis. This audit report could include false positives, false negatives, and other unpredictable results.

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SecureDApp is built by a decentralized team of UI experts, contributors, engineers, and enthusiasts from all over the world. Our team currently consists of 6+ core team members, and 10+ casual contributors. SecureDApp provides manual, static, and automatic smart contract analysis, to ensure that the project is checked against known attacks and potential vulnerabilities.

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